

Certification Test Plan – Modification

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Prepared for:

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EAC Application No.	HRT-Verity-2.3.4
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**Accredited by the Election
Assistance Commission (EAC)
for Selected Voting System Test
Methods or Services**



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1 INTRODUCTION

This Modification Certification Test Plan outlines the test approach SLI Compliance will follow when performing Certification Testing on the **Hart Verity Voting 2.3.4** voting system against the 2005 Voluntary Voting System Guidelines 1.0 (VVSG 1.0). **Verity Voting 2.3.4** is a modification of **Verity Voting 2.3**, with limited changes. The system will be tested based on the “modified system” requirements, as set forth in section 4.6.2.3 of the “**EAC** Voting System Testing and Certification Program Manual, version 2.0”.

When the testing is complete, SLI will submit a Certification Test Report that details all test results and findings from the Certification Test effort, as well as a recommendation to the **EAC**.

1.1 Description and Overview of the Certified System

This test plan contains a description of the specific modifications to the current system version, and the impact of those modifications on the system and certification testing.

1.1.1 Definition of the Baseline Certified System

This modification project builds upon the foundation established in **Verity Voting 2.3**, which contained the applications **Verity Data**, **Verity Build**, **Verity Central** and **Verity Count**, as well as the polling place devices **Verity Scan**, **Verity Touch**, **Verity Print**, **Verity Touch Writer** and **Verity Touch Writer Duo**.

1.1.2 Modifications

Verity Voting 2.3.4 is a modification of the EAC-certified **Verity Voting 2.3** system.

The modifications to **Verity 2.3.4** address updates for **Verity Touch Writer** and **Verity Touch Writer Duo**, as requested by the State of Pennsylvania:

- Straight party deselection behavior on the electronic interface of Touch Writer and Touch Writer Duo
- Modifications to Touch Writer to inform the voter that they cannot create a situation where a straight-party preference is selected and a down-ballot contest on the paper ballot is left completely unmarked, that they would need to deselect their straight party preference.

Review of the modifications implemented, and source code modified indicates the need for a limited Functional Configuration Audit in order to verify that the system continues to meet 2005 VVSG 1.0 requirements. The limited FCA takes into account not only the implemented modifications, but also functions that have not changed but may be impacted by a modification.



Software/firmware that either has modified source code or requires a new build will be subjected to an FCA review.

Verity Touch Writer and **Verity Touch Writer Duo** both have modified source code and will require new builds.

1.1.3 Initial Assessment of Impact of the Modifications

Verity Touch Writer

Verity Touch Writer has been modified to notify a voter that they cannot create a situation where a straight-party preference is selected and a down-ballot contest on the paper ballot is left completely unmarked. Touch Writer will identify when a voter attempts to deselect the last mark in a down-ballot straight party-affiliated contest, and will present a message to the voter, indicating that they will need to deselect their straight party preference prior to being able to leave a down-ballot contest completely unmarked.

Verity Touch Writer and Verity Touch Writer Duo

The behavior when selecting then deselecting a straight party choice has been modified on **Verity Touch Writer** and **Verity Touch Writer Duo** as follows:

- Marks in down-ballot partisan contests that were added by straight party logic are removed.
- Down-ballot partisan contests that were manually marked by the voter are not affected.
- Down-ballot non-partisan contests are not affected.

1.1.4 Regression Testing

This section describes what system elements will be regression tested to establish assurance that the modifications have no adverse impact on the compliance, integrity or performance of the system.

One system level general election, one system level open primary election and one system level closed primary election test will be performed to verify system robustness.

Each system level test incorporates all major components of the **Verity Voting 2.3.4** voting system, including **Verity Data**, **Verity Build**, **Verity Central** and **Verity Count**, **Verity Scan**, **Verity Touch**, **Verity Print**, **Verity Touch Writer** and **Verity Touch Writer Duo**.



1.2 References

The following key documents were used in preparing this test plan.

1. Election Assistance Commission Voluntary Voting System Guidelines (EAC VVSG), 2005 Version 1.0 Volumes I and II.
2. NIST Handbook 150: 2016.
3. NIST Handbook 150-22: 2017.
4. EAC Voting System Testing and Certification Program Manual, United States Election Assistance Commission, v 2.0, May 2015
5. SLI VSTL Quality System Manual, Rev. 3.0, prepared by SLI, dated February 13, 2019.

1.3 Terms and Abbreviations

The following terms and abbreviations will be used throughout this document:

Table 1 – Terms and Abbreviations

Term	Abbreviation	Description
Ballot Marking Device	BMD	An accessible computer-based voting system that produces a marked ballot (usually paper) that is the result of voter interaction with visual or audio prompts.
Central Count Scanner	CCS	The CCS High Speed Digital Scanner is a mark sense-based ballot and vote counting device typically located at a central count facility and operated by an automated multi-sheet feeding capability.
Compact Flash card	CF	This is a type of flash memory card in a standardized enclosure often used in voting systems to store ballot and/or vote results data.
Compact Flash AST	CFAST	A compact flash media based on the Serial ATA bus rather than the Parallel ATA bus, used by the original CompactFlash.
Chevron	No Abbreviation	Verity components use workflow chevrons. Workflow chevrons, arranged along the top of the screen, identify the function the user is currently viewing.
Commercial Off the Shelf	COTS	Term used to designate computer software, hardware or accessories that are ready-made and available for sale, lease, or license to the general public.
Direct Recording Electronic	DRE	Voting systems that, using touch screen or other user interfaces, directly record the voter's selections in each race or contest on the ballot in electronic form.



Term	Abbreviation	Description
Election Assistance Commission	EAC	An independent, bipartisan commission created by the Help America Vote Act (HAVA) of 2002 that operates the federal government's voting system certification program.
Election Management System	EMS	Typically, a database management system used to enter jurisdiction information (district, precincts, languages, etc.) as well as election specific information (races, candidates, voter groups (parties), etc.). In addition, the EMS is also used to lay out the ballots, download the election data to the voting devices, upload the results and produce the final results reports.
Electromagnetic Compatibility	EMC	The goal of EMC is to validate the correct functioning of different equipment in the same environment and the avoidance of any interference effects between them.
Functional Configuration Audit	FCA	The testing activities associated with the functional testing of the system.
National Institute of Standards and Technology	NIST	A non-regulatory federal agency within the U.S. Dept. of Commerce. Its mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.
National Voluntary Laboratory Accreditation Program	NVLAP	A division of NIST that provides third-party accreditation to testing and calibration laboratories.
Physical Configuration Audit	PCA	The testing activities associated with the physical aspects of the system (hardware, documentation, builds, source code, etc.).
Precinct Count Scanner	PCS	A digital scanner is a mark sense-based ballot and vote counting device located at a polling place and is typically operated by scanning one ballot at a time.
Request For Information	RFI	A means used by testing laboratories and manufacturers to request that the EAC provide an interpretation of a technical issue related to testing of voting systems.
Requirements Matrix	N/A	A matrix that traces the VVSG requirements to the various test modules and test methods.



Term	Abbreviation	Description
Standard Lab Procedure	SLP	SLI's quality system documentation is made up of standard lab procedures (SLPs), which are procedures required to ensure a systematic, repeatable and accurate approach to voting systems testing and governing the actual performance of SLI's work.
Technical Data Package	TDP	The data package supplied by the vendor, which includes Functional Requirements, Specifications, End-user documentation, Procedures, System Overview, Configuration Management Plan, Quality Assurance Program, and manuals for each of the required hardware, software, firmware components of a voting system.
Test Method	TM	SLI proprietary documents which are designed to group sets of EAC VVSG requirements in a logical manner that can be utilized to more efficiently validate where and how requirements, or portions of a requirement, are met.
Validation	No Abbreviation	Confirmation by examination and through provision of objective evidence that the requirements for a specific intended use or application have been fulfilled (ISO 9000).
Verification -	No Abbreviation	Confirmation by examination and through provision of objective evidence that specified requirements have been fulfilled (ISO 9000).
Verity vDrive	vDrive	Media used for transportation of voting system data
Voluntary Voting System Guidelines	VVSG	A set of specifications and requirements against which voting systems can be tested to determine if the systems provide all of the basic functionality, accessibility and security capabilities required for EAC certification.
Voter Verifiable Paper Audit Trail	VVPAT	An independent verification system for voting machines designed to allow voters to verify that their vote was cast correctly, to detect possible election fraud or malfunction, and to provide a means to audit the stored electronic results.
Voting System Test Lab	VSTL	An independent testing organization accredited by NVLAP and the EAC to conduct voting system testing for EAC certification.
Voting System Under Test	VSUT	The designation for a voting system that is currently being tested.



Term	Abbreviation	Description
Voting Test Engineer	VTE	An SLI employee within the Compliance division who has been qualified to perform EAC voting system certification testing.

1.4 Testing Responsibilities

The subsections below describe the project responsibilities.

1.4.1 Owner Assignments

- System analysis and review will be conducted by Test Engineers including Source Code Review, Security and Voting Test Specialists, with oversight by the Test Manager.
- Source code review will be conducted by Source Code Review Test Engineers, with oversight by the Test Manager.
- Documentation review will be conducted by Test Engineers, with oversight by the Test Manager.
- Test module development and validation will be conducted by Security and Voting Test Engineers, with oversight by the Test Manager.
- Test suite development and validation will be conducted by Security and Voting Test Engineers, utilizing SLI's formal Test Methods, with oversight by the Test Manager.
- Formal test execution will be conducted by Security and Voting Test Engineers, with oversight by the Test Manager.



1.4.2 Project Timeline

The following schedule outlines the expected timeline for this project.

ID	Task Name	Start	Finish
1	Hart Verity 2.3.4 Federal Certification Project Plan	Mon 4/22/19	Wed 7/3/19
2	Test Readiness Review (TRR)	Fri 4/26/19	Tue 4/30/19
12	Phase 1	Mon 4/22/19	Mon 5/27/19
13	Project Initiation	Thu 5/2/19	Thu 5/2/19
14	Kick Off Meeting with Hart, SLI & EAC	Thu 5/2/19	Thu 5/2/19
15	TDP Deliver/Receive Vendor Package	Fri 4/26/19	Fri 4/26/19
46	TDP Review	Mon 4/22/19	Thu 5/2/19
47	Review - Source Code	Mon 4/22/19	Tue 4/23/19
64	PCA Document Review	Fri 4/26/19	Thu 5/2/19
99	FCA Assessment	Wed 5/1/19	Thu 5/2/19
104	Test Plan Development	Fri 5/3/19	Mon 5/27/19
105	Create Test Plan	Fri 5/3/19	Mon 5/6/19
106	Submit Test Plan for EAC Review (20 day period)	Mon 5/6/19	Mon 5/6/19
107	Updates to Test Plan to Resolve EAC comments	Mon 5/27/19	Mon 5/27/19
108	EAC Review	Mon 5/27/19	Mon 5/27/19
109	Test Plan Development Complete - MS	Mon 5/27/19	Mon 5/27/19
110	Phase 2	Thu 5/2/19	Thu 5/2/19
111	Test Suite Development	Thu 5/2/19	Thu 5/2/19
113	Phase 3	Fri 4/26/19	Fri 4/26/19
114	Vendor Specific Module and Suite Creation	Fri 4/26/19	Fri 4/26/19
121	Phase 4	Fri 4/26/19	Mon 4/29/19
122	Trusted Build	Fri 4/26/19	Fri 4/26/19
129	Test Suite Validation	Fri 4/26/19	Fri 4/26/19
130	Validate Test Suites	Fri 4/26/19	Fri 4/26/19
136	Discrepancy Report	Fri 4/26/19	Fri 4/26/19
138	Phase 5	Mon 4/29/19	Fri 5/3/19
139	Official Test Execution of Test Suites	Mon 4/29/19	Fri 5/3/19
140	Prep Test Environment	Mon 4/29/19	Tue 4/30/19
142	Execute Test Suites	Tue 4/30/19	Thu 5/2/19
147	Final Documentation Updates	Thu 5/2/19	Fri 5/3/19
149	Phase 6	Mon 4/22/19	Fri 6/28/19
150	Certification Test Report and Final Test Plan	Mon 5/27/19	Tue 6/25/19
151	Final updates to Test Plan w/ EAC Review	Mon 5/27/19	Mon 5/27/19
152	Create Test Report	Mon 5/27/19	Tue 5/28/19
153	Final updates to Test Report	Mon 6/24/19	Mon 6/24/19
154	EAC Review Complete	Tue 6/25/19	Tue 6/25/19
155	Delivery of Artifacts to EAC Repository	Fri 6/28/19	Fri 6/28/19
158	Project Management	Mon 4/22/19	Thu 6/27/19
160	Phase 7	Tue 7/2/19	Wed 7/3/19
161	Return Equipment to Vendor	Wed 7/3/19	Wed 7/3/19
164	Archive Test Materials	Tue 7/2/19	Tue 7/2/19



1.4.3 Test Module Development and Validation

Test modules will be developed to provide repeatable detailed test steps. The modules are defined at a basic level in SLI's formal Test Methods and are designed for use in any suite that employs their functionality. This reusability reduces the development time associated with creating modules. The modules will be validated prior to formal test execution to ensure accurate testing of the voting system. Additionally, the test modules will provide traceability to SLI's formal Test Methods, as well as the 2005 VVSG 1.0 requirements. This is done by listing the Test Method name, and each requirement addressed, in the module.

1.4.4 Trusted Build

Prior to formal test execution, a trusted build will occur in order to include modifications made to the voting system.

1.4.5 Formal Test Execution

Formal execution of the validated Test Suites and modules will be conducted to verify the system's compliance with the 2005 VVSG 1.0 requirements.

1.4.6 Third Party Hardware Testing

No hardware testing will be performed on any of the devices, as the updates are software specific functionality.

1.4.7 EAC & Manufacturer Dependencies

The Test Plan will require **EAC** approval prior to finalization.

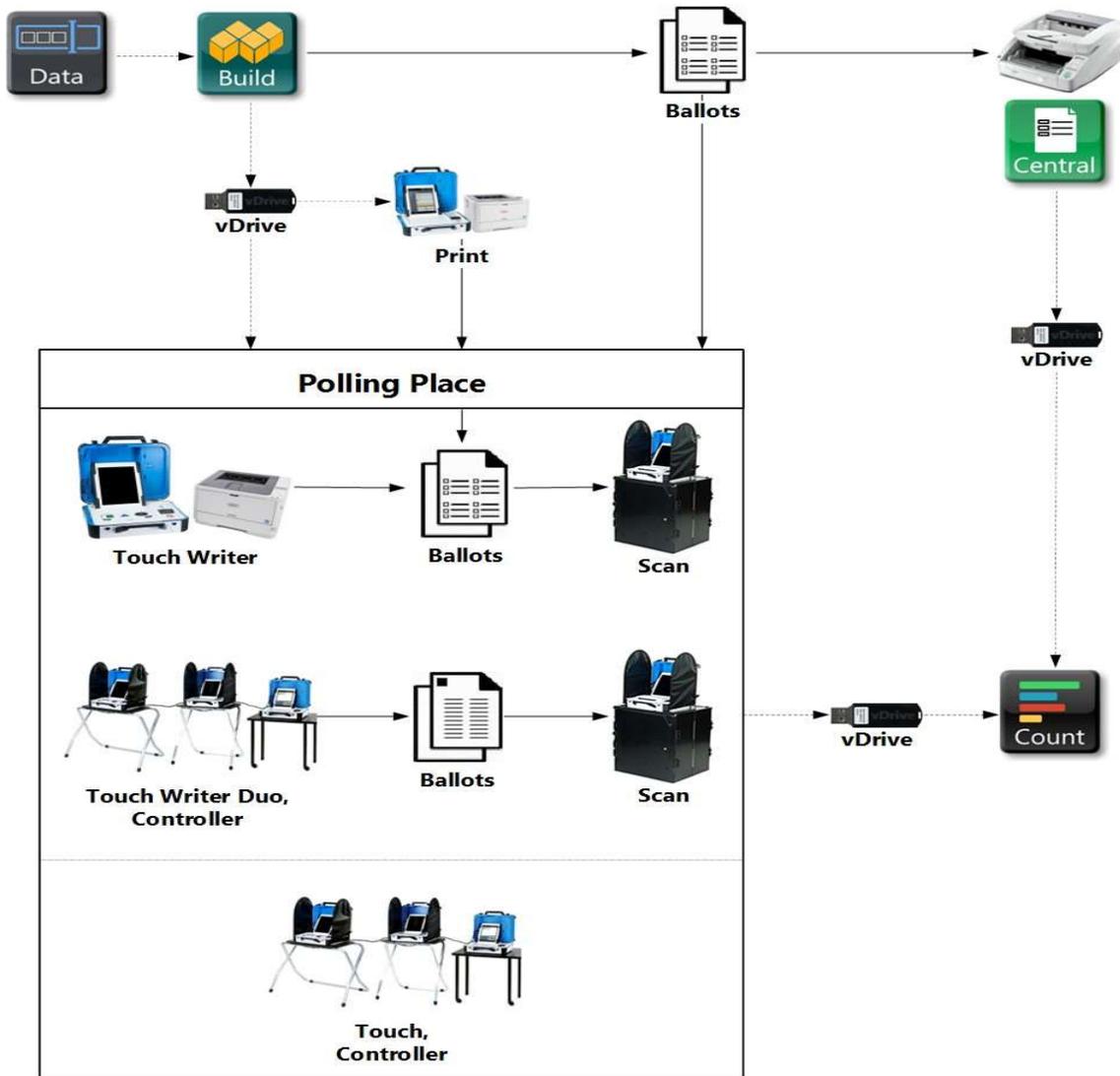
Hart will be required to provide all source code, documentation, equipment and supporting materials identified as part of the voting system.

The source code must have all discrepancies resolved, be able to be built successfully, and installed.

In addition, **Hart** is required to provide training on the voting system and support throughout the life of the project.

1.5 Scope of Testing

1.5.1 Block Diagram



Overview of the diagram:

- The components are displayed as touch points of data access, transfers, and verification.
- Dotted lines show the flow of data and air gaps using vDrives and are also used to separate the deployment models shown within the polling place.
- Verity Print is a ballot production device that provides unmarked printed ballots.
- Verity Touch Writer and Scan may be installed in polling places to support paper-based voting.



- Verity Controller, Touch Writer Duo, and Scan may be installed in polling places to support paper-based voting.
- Verity Controller and Touch may be installed in polling places to support DRE voting.
- Verity Key (not shown) is required for user access into components to load election elections, to use critical features, and to generate reports. Feature access depends on the roles applied to user accounts.

1.5.2 EAC Request For Interpretation – RFI

No RFI, related to VVSG 1.0, is relevant to the updates in this modification project.

1.5.3 EAC Notices of Clarification - NOC

This Certification Test Plan and the execution of tests for the voting system identified in this plan account for the following NOCs:

- NOC 13-02: Detailed Description of Changes for Modifications
- NOC 09-005: Development and Submission of Test Plans for Modifications to EAC Certified Systems.
- NOC 09-002: Clarification of EAC Laboratory Independence Requirement
- NOC 09-001: Clarification of the Requirements for Voting System Test Laboratories (VSTLs) Development and Submission of Test Plans
- NOC 08-003: Clarification of EAC Conformance Testing Requirements for Voting System Test Laboratories (VSTLs)

2 PRE-CERTIFICATION TESTING AND ISSUES

2.1 Evaluation of prior VSTL testing

Prior VSTL testing has been performed on predecessor versions of the **Hart Verity Voting 2.3.4** voting system. A full test campaign was done by SLI during the **Verity Voting 2.0** EAC certification project. A modification test campaign was done during the **Verity Voting 2.3** EAC certification project. The **Verity Voting 2.3** release constitutes the main code base used for the **Verity Voting 2.3.4** release.

2.2 Evaluation of prior non-VSTL testing

No non-VSTL lab testing has been performed on the **Hart Verity Voting 2.3.4** voting system. The State of Pennsylvania has performed testing on this voting system and is in agreement with the modifications implemented. Review of Hart's internal testing is performed during the FCA review.



2.3 Known Field Issues

The **Hart Verity Voting 2.3.4** voting system is a modification of **Verity Voting 2.3**.

For the **Verity Voting 2.3.4** system, the voting devices are the **Verity Scan** precinct digital scanner, which processes ballots marked by voters, **Verity Touch Writer**, a ballot marking device, **Verity Touch Writer Duo**, a print voter record device, **Verity Touch**, a direct recording electronic device, and **Verity Print**, a pre-voting ballot production device that is used to print blank ballots.

Review of the “Known Vulnerabilities” database, maintained by SLI, has provided no known vulnerabilities that relate to the modifications implemented in **Verity Voting 2.3.4**.

3 MATERIALS REQUIRED FOR TESTING

Any materials that are used in an election cycle must be provided to SLI to facilitate testing of the voting system. This section outlines these required materials.

3.1 Software/Firmware

All software and firmware that is to be used by the declared voting system, whether directly or indirectly, in a production environment, must be validated during the certification process.

The following software/firmware is required. This includes all supporting software such as operating systems, compilers, assemblers, application software and firmware, any applications used for burning of media, transmission of data or creation/management of databases.

3.1.1 Hart Verity Voting 2.3.4 Software/Firmware

The **Hart Verity Voting 2.3.4** voting system consists of the following major software and firmware components:

- **Verity Data** EMS software
- **Verity Build** EMS software
- **Verity Central** high speed optical scanner software
- **Verity Count** central count location tabulation and reporting software
- **Verity Scan** optical scanner firmware
- **Verity Touch Writer** BMD firmware
- **Verity Touch Writer Duo** BMD firmware
- **Verity Controller** firmware
- **Verity Touch** DRE firmware



- **Verity Print** printer firmware
- **Verity Device** Microcontroller firmware for **Verity** devices

Note: Versions for each will be available after execution of the trusted build and will be listed in the Test Report.

3.1.2 COTS Software/Firmware

This section details the Commercial Off The Shelf software and firmware utilized within the **Verity Voting 2.3.4** system.

Table 2 – COTS Software/Firmware

Manufacturer	Application	Version	Verity Voting 2.3.3 Component
Microsoft	Microsoft Windows Embedded Standard 7 with Service Pack 1	6.1.7601	Data/Build, Data/Build + Count, Central, Count, Print, Touch Writer, Scan, Touch Writer Duo, Controller, Touch, Touch with Access
Microsoft	Microsoft SQL Server 2012 for Embedded Systems	11.00.2100	Data/Build, Data/Build + Count, Central, Count
Microsoft	Microsoft SQL Server 2012 Express	11.00.2100	Print, Touch Writer, Scan, Touch Writer Duo, Controller, Touch, Touch with Access
McAfee	McAfee Application Control for Devices	6.1.1.369	Data/Build, Data/Build + Count, Central, Count, Print, Touch Writer, Scan, Touch Writer Duo, Controller, Touch, Touch with Access
Nuance Communications	Nuance Western OCR, Desktop, OEM	V20	Verity Scan

3.1.3 Additional Supporting Test Software

This section outlines all test specific software that will be used in the certification campaign.

Table 3 – Additional Supporting Test Software

Manufacturer	Application
LocMetrics	<u>LocMetrics Line Counter</u> , a commercial application used to determine the counts of executable and comment lines
SLI	<u>Module Finder</u> , a SLI proprietary application used to parse module names from C/C++, Java and VB code and populate the identified module names into the review documents



Manufacturer	Application
PrestoSoft	ExamDiff Pro: a commercial application used to compare revised code to previously reviewed code

3.2 Equipment

The following equipment is required for the execution of the hardware, software and security tests. This includes system hardware, general purpose data processing and communications equipment, and any test instrumentation required.

3.2.1 Hart Verity Voting 2.3.4 Custom Equipment

The following **Hart Verity Voting 2.3.4** custom equipment will be used in testing:

Table 4 – Hart Verity Voting 2.3.4 Equipment

Hardware
Verity Scan (digital scanner)
Verity Touch (DRE)
Verity Touch Writer (BMD)
Verity Touch Writer Duo (BMD)
Verity Print
Verity Controller

3.2.2 COTS Equipment

The following Commercial Off-the-Shelf equipment will be used in testing:

- Desktops
- Printers
- Scanners

Table 5 – COTS Equipment

Manufacturer	Hardware	Model
OKIDATA (for Verity Data, Verity Build, Verity Print, Verity Central, Verity Touch Writer, Verity Touch Writer Duo and Verity Count)	Ballot and Report Printer	B432dn
OKIDATA (for Verity Print, Verity Build)	Ballot Printer	C831dn
Various (for Verity Data, Verity Build, Verity Central and Verity Count)	Intel-Windows Workstation (Minimum Requirements)	



Manufacturer	Hardware	Model
	Processor – Intel Celeron D 420 3.06GHz Dual Core Memory – 2GB Hard Drive – 120 GB Removable Storage – 8xDVD+/-RW Slim line USB Ports – 4 ports Video Card - Integrated Graphics Keyboard - USB Keyboard Mouse - USB Mouse	
Various (for Verity Data, Verity Build, Verity Central, Verity Count, Verity Relay)	Monitor (Minimum Requirements) Panel Size - 50.8 cm Aspect Ratio - Widescreen (16:9) Optimal Resolution - 1600 x 900 at 60Hz Contrast Ratio - 1000: 1 Brightness - 250 cd/m2 (typical)	
Canon (for Verity Central)	Ballot Scanner	DR-G1100
Canon (for Verity Central)	Ballot Scanner	DR-G1130

3.3 Test Materials

The following test materials are required for the performance of testing including, as applicable, test ballot layout and generation materials, test ballot sheets, test ballot cards and control cards, standard and optional output data report formats, and any other materials used in testing.

- Ballots & Blank Ballot grade paper
- Thumb Drives
- USB Dongle
- Ballot marking pens
- Printer paper rolls

3.4 Deliverable Documents

The following are documents to be delivered as a part of the **Hart Verity Voting 2.3.4** system.

- All-In-One Code Framework Coding Standards
- Configuration Management Process 1001074 D01
- Continual Improvement Process 1000550 E02
- Control of Nonconforming Product Procedure 1000657 B02
- Device Configuration Process Document 4005523 B00



- Device OS Creation and Configuration Process Document Verity 2.3 4005563 A01
- Device WES7 Creation Process Document Verity 4005562 A01
- Document Control Procedure 1000538 E05
- Factory TUV SUD inspection 2018 June report signed
- Hardware 2005713-CFAST Door Security Kit Design
- Hardware 3005018-ATI Kit Design
- Hardware 3005174-AutoBallot Kit Design
- Hardware 3005350-Scan Design
- Hardware 3005351-Controller Design
- Hardware 3005353-Touch with Access Design
- Hardware 3005355-Touch Design
- Hardware 3005356-Print Design
- Hardware 3005357-Ballot Box Design
- Hardware 3005358-Standard Booth Design
- Hardware 3005359-Accessible Booth Design
- Hardware 3005725-Touch Writer Duo Design
- Hardware 3005800-Scan Design
- Hardware 3005801-Accessible Booth With ATI Tray Design
- Hardware 3005825-Controller Design
- Hardware 3005855-Touch Writer Design
- Hardware Design Development Procedure 1000513 D01
- Hardware PCB Photos
- Hardware Verification and Validation Process 1000514 D01
- Hart NRTL Safety Certificate U8 17 10 90917 004
- Hart Secure Ballot Stock Specification 4005526 A01
- HPQC Test Cases
- Notice of Protected Information 1000775 A00
- Quality Manual 1000490 D04
- Record Retention Matrix 1000510 E02
- Software Design Development Procedure 1000566 D02
- Software Production 1000551 E01
- Software Test Design Development 1000508 D02
- Software Verification and Validation Process 1000560 D02
- Software Versioning Procedure 1001070 C04
- SQA Requirements Management Process 1000540 A02
- Supplier Qualification and Management 1000563 C02
- The Creation and Configuration of the Access Build Environment 4005517 A01
- The Creation and Configuration of the MCU Build Environment 4005519 A02



- The Creation and Configuration of the Trusted Build Environment 4005518 A03
- Verity 2.3.4TDP Abstract 1000774 A00
- Verity 2.3.4 VVSG 1.0 TDP Trace
- Verity 2.3.X COTS List
- Verity Airgap Interface Technical Reference 4005512 A02
- Verity Application Framework TRD 4005634 A00
- Verity Application Installer Build Process Document Verity 2.3.1 4005641 A01
- Verity Application Programming Interface Specification 4005604 A04
- Verity Ballot Creation TRD 4005636 A00
- Verity Base Station Microcontroller Specification 4005462 A01
- Verity Build TRD 4005628 A00
- Verity Central TRD 4005632 A00
- Verity Coding Standard 4005498 A14
- Verity Controller TRD 4005624 A01
- Verity Count TRD 4005629 A01
- Verity Data TRD 4005627 A00
- Verity Database Attributes 4005543 C02
- Verity Device Suite TRD 4005621 A00
- Verity Election Definition Data TRD 4005639 A01
- Verity Election Management TRD 4005631 A00
- Verity Electronics Specification 4005461 A15
- Verity Entity Relationship Diagram Database - Devices
- Verity Entity Relationship Diagram Database - Servers (Count Only)
- Verity Entity Relationship Diagram Database - Servers (No Count)
- Verity Key Design 4005514 A02
- Verity Logging Design NR 103
- Verity Logging TRD 4005635 A00
- Verity Operational Environment 4005515 C06
- Verity PC Application Framework User Interface Design Document
- Verity Performance Characteristics 4005497 C02
- Verity Print TRD 4005626 A00
- Verity Risk and Threat Assessment 4005513 B01
- Verity Scan TRD 4005623 A00
- Verity Security Requirements 4005464 A07
- Verity Shared Device User Interface Design Document
- Verity Software Architecture-Design 4005463 B01
- Verity Summative Usability Report 4005496 A00
- Verity Summative Usability Test Plan 4005495 A01
- Verity Supply Chain PRD 4005302 C01
- Verity System Limits 4005470 C01



- Verity Touch TRD 4005633 A00
- Verity Touch Writer Duo Base Station Microcontroller Specification 4005638 A00
- Verity Touch Writer Duo TRD 4005625 A00
- Verity Touch Writer TRD 4005622 A00
- Verity User Management TRD 4005630 A00
- Verity Vote Counting and Cast Vote Records TRD 4005640 A00
- Verity Voting 2.3.4 Change Notes
- Verity Voting 2.3.4 Implementation Statement 4005648 A00
- Verity Voting 2.3.4 Source Documentation.zip
- Verity Voting 2.3.4 Usability Impact Statement
- Verity Voting National Certification Test Specification 4005527 B02
- Verity Workstation Manufacturing 4005525 B01
- Verity_2.3_Administrators Guide_Build 6641-021 A01
- Verity_2.3_Administrators Guide_Central 6641-022 A02
- Verity_2.3_Administrators Guide_Count 6641-023 A03
- Verity_2.3_Administrators Guide_Data 6641-020 A02
- Verity_2.3_Device Troubleshooting Field Guide 6653-005 A03
- Verity_2.3_Polling Place Field Guide - CDS 6651-012 A02
- Verity_2.3_Polling Place Field Guide - CT 6651-014 A02
- Verity_2.3_Polling Place Field Guide - SW 6651-013 A01
- Verity_2.3_Support Procedures Guide 6643-005 A03
- Verity_2.3_System Administrators Guide 6641-024 A02
- Verity_2.3_Verity Print Field Guide 6651-015 A01
- VirTex Q01 Quality Manual Rev R
- Voting System Implementation and Maintenance 1000745 C02
- VSTL Product Submission Procedure 1000565 D02
- Workstation Configuration Process Document Verity 2.3 4005564 A01
- Workstation WES7 Creation Process Document Verity 2.0 4005565 A00



4 TEST SPECIFICATIONS

The following are the specifications for testing to be conducted on the **Hart Verity Voting 2.3.4** system. The specifications contain details on the focus of testing, configuration(s), and the functions to be tested.

4.1 VVSG Requirements

4.1.1 Functional Requirements

The **Verity Voting 2.3.4** modification will be tested to the 2005 VVSG 1.0 requirements listed below:

Volume I:

- 2.1.2.c Accuracy
- 2.1.7.1.c Functions
- 2.2.4.d Readiness Testing
- 2.3.3.1.c Common Requirements
- 2.3.3.2.b Paper based System Requirements
- 2.3.3.3.c,o DRE System Requirements

Volume II:

- 3.2.3 Testing to Reflect Additional Capabilities
- 3.2.4 Testing to Reflect Previously Tested Capabilities
- 6.2.2 System Baseline for Testing

4.1.2 Test Methods

All test methods employed are within the scope of SLI’s VSTL accreditation.

The following validated test methods will be employed during this test campaign:

Test Methods

SLI VSTL Test Method Name
TM_Accuracy v1.2
TM_Basic_Election_Components v1.1
TM_Readiness v1.1
TM_Tally_and_Reporting v1.1
TM_Voting_Capabilities v1.3
TM_Voting_Straight_Party v1.2

The above listed test methods are implemented in a complementary fashion: modules are employed from various methods to form suites. Suites included the



logical sequence of functionality that was used to validate the requirements addressed by each module within the suite.

4.1.3 Hart State Specific Modifications

The modifications addressed represent Hart internally developed features designed to satisfy jurisdictional requests made by the State of Pennsylvania.

4.2 Hardware Configuration and Design

The **Hart Verity Voting 2.3.4** system, as declared in the application for certification submitted to the EAC, consists of:

- A **Verity Data/Build** workstation to create all election information and election media.
- **Verity Print** is a pre-voting ballot production device that is paired with COTS printer, to produce unmarked paper ballots.
- At the precinct level, **Verity Scan** optical scanners, **Verity Touch DRE** and **Verity Touch Writer BMD**, and **Verity Touch Writer Duo BMD** configurations are employed.
- The central count location employs a high speed COTS scanner, in combination with a workstation that utilizes the **Verity Central** software, for tabulation of paper ballots.
- The consolidation, tally and reporting location employs a workstation with **Verity Count** software as well as a printer.

4.3 Test Suite Design

4.3.1 Software Functional Test Design and Data

SLI has prepared functional test modules using the operator/user procedures specified in the TDP. Functionality provided by the **Verity Voting 2.3.4** voting system is exercised in order to verify that each functional component performs as expected. Accept/reject criteria are based on requirements of the VVSG and the system specification documents provided within the TDP. As many of the individual functional components rely on preceding functionality within the system, SLI incorporates system level suites that employ modules that exercise the individual functional components of the system.

After analysis of the changes incorporated into the **Verity Voting 2.3.4** voting system, the following tests are implemented.

General Election test suite – The **Verity Voting 2.3.4** voting system will be reviewed in order to verify continued integration of the voting system and that all components continue to work as expected.



Closed Primary Election test suite – The **Verity Voting 2.3.4** voting system will be reviewed in order to verify continued integration of the voting system and that all components continue to work as expected.

4.4 TDP Evaluation

SLI is completing an assessment of the deliveries of the Technical Data Package for **Verity Voting 2.3.4** against the **Verity Voting 2.3** TDP. Any modification to previously reviewed documentation is being reviewed.

4.4.1 Document Review

SLI conducts a PCA review of all modified vendor documents submitted for review in the delivery of the **Hart Verity Voting 2.3.4** TDP. These include:

- System configuration overview
- System functionality description
- System hardware specifications
- Software design and specifications
- System test and verification specifications
- System security specifications
- User/system operations procedures
- System maintenance procedures
- Personnel deployment and training requirements
- Configuration management plan
- Quality assurance program
- System change notes

Documents are verified for compliance to the 2005 VVSG, Volume 2, Sections 2.2 through 2.13 and Volume 2, Section 6.6. Unless noted otherwise, all requirements are successfully met within the pertinent areas of the TDP.

4.5 Source Code Review

The certification campaign for the **Hart Verity Voting 2.3.4** voting system includes proprietary software and firmware that have been created/modified by **Hart**. SLI has conducted a source code review of all modified proprietary source code submitted in the delivery of the voting system for compliance to the VVSG version 2005, Volume 2, Section 6.6. No COTS products were modified for this voting system version.

The coding languages involved in the vendor's applications include:

- C



- C++
- C#

Source Code Review Tools utilized by SLI include:

- Practiline Line Counter: a commercial application used to determine the counts of executable and comment lines;
- Module Finder: an SLI proprietary application used to parse module names from C/C++ and VB code and populate the identified module names into the review documents;
- ExamDiff Pro: a commercial application used to compare revised code to previously reviewed code; and

Any subsequent re-reviews of source code will be the result of fixes to discrepancies identified in the Functional Configuration Audit activities.

COTS operating systems and software used in the voting system have been verified as authentic and unmodified in the **Verity Voting 2.3.4** test campaign.

4.6 QA & CM Process Review

The review processes employed are designed to verify that the manufacturer not only has documented processes and procedures in both the Quality Assurance and Configuration Management arenas, but that those processes and procedures are actually implemented within the software development life cycle that is used to produce the **Hart Verity Voting 2.3.4** version that is submitted for certification.

The QA portion of the review focuses on the testing performed by the system's manufacturer, **Hart InterCivic**. The scope of the testing performed is reviewed in order to verify that the manufacturer has verified all VVSG requirements are met. SLI reviews the test case design documents and data as provided by **Hart InterCivic**. In evaluating selected modules with respect to flow control parameters and data on both entry and exit, SLI assesses for discrepancies between the Software Specifications and the test case design. Additionally, interviews of key Quality Assurance staff may be conducted to verify that the QA processes and procedures are known, understood and implemented by the appropriate personnel within the organization.

The CM portion of the review focuses on the organization's understanding and implementation of the declared configuration management processes, procedures and policies. Initial deliverables will be reviewed against all pertinent CM processes employed by **Hart**. All subsequent deliveries will also be reviewed to determine that appropriate processes are employed. Additionally, interviews of pertinent staff, with regard to configuration management, may be conducted if determined to be necessary to verify that processes, procedures and policies are known, understood and implemented within the organization.



4.7 Trusted Build

The trusted build will be conducted prior to SLI's official testing and will be completed on site at SLI's facility. SLI will use its approved standard lab procedure that details the processes for controlling, managing, and conducting the trusted build. This process includes the following:

- Preparations for the trusted build – Obtaining and reviewing Hart's procedure for constructing the build platform, verifying the target build platform, and acquiring and verifying the necessary materials, if rebuild of the existing environment is needed.
- Execution of the trusted build – SLI will perform the trusted build by using the step-by-step build procedure, as provided by **Hart** to create a pristine build environment. SLI ascertains and records the following items throughout the build process:
 - Build environment images at various key points
 - Build environment and file hashes at various key points
 - Build environment hardware characteristics
 - Build results from code compilation and file hashes
 - Final software install files and file hashes
 - Build virtual machine files
- Deliverables to testing – Upon completion of the trusted build, certain items are sent to the SLI test group. The final result will be a media containing the following:
 - Final software install files
 - Hash values to validate install files
- Final record keeping and archiving procedures – At the conclusion of the trusted build process, SLI completes all final record keeping and archiving procedures at SLI's facility. This record keeping includes any unique identifiers, results of the build with version numbers and dates, and descriptions of all hashes and images in the repository.

4.8 Standard VSTL Test Methods and Uncertainty of Test Data Measurement

This test campaign utilizes Standard VSTL test methods and election specific type test data only.



5 TEST DATA

Test data for the **Hart Verity Voting 2.3.4** voting system has been compiled such that all modified functionality will be tested to determine conformance to the standards.

5.1 Data Recording

SLI has evaluated the system functionality, as described by **Hart** technical documentation, as well as requirements as listed in the EAC 2005 VVSG 1.0, and made determinations as to expected results of all data inputs into the **Hart Verity Voting 2.3.4** voting system. This includes:

- Election type
- Precincts of all types
- Districts
- Offices
- Contests
- Candidates
- Parties
- Devices used
- Voting variations employed
- Issues/Referendums
- Votes cast for each candidate/issue/referendum
- Vote consolidation data from one device/level to the next

The data is contained in one master data record, including each input and each expected output. This data is incorporated into the appropriate test suite.

Testing information is recorded in the test suites, as well as in test notebooks, which are utilized according to SLI's standard lab procedure *SLP-VC-30 - Test Notebooks*.

5.2 Test Data Criteria

SLI has evaluated the system functionality as described by Hart technical documentation, as well as requirements as listed in the EAC 2005 VVSG 1.0 and made determinations as to expected output of all data inputs into the **Hart Verity Voting 2.3.4** voting system. The system's execution shall be measured against the expected results.



6 TEST PROCEDURE AND CONDITIONS

This section describes the test conditions and procedures for execution of test suites. Additionally, this section is used to describe procedures for setting up equipment that will be utilized in the execution of the test suites.

6.1 Facility Requirements

Testing will be performed on site at SLI in Denver, Colorado.

Multiple secure labs are available with appropriate power supply and space to accommodate the various configurations defined within this test plan. Temperature/humidity gauges will be employed in order to determine the appropriate conditions exist during testing.

Unless otherwise specified herein, all remaining tests, including system level functional testing, shall be performed at standard ambient conditions:

- Temperature: 25°C ± 10°C (77°F ± 18°F)
- Relative Humidity: 20 to 90%
- Atmospheric Pressure: Local Site Pressure

All TDP and test documentation is stored on site at SLI's facility in a secure project directory on SLI's secure servers.

6.2 Test Setup

Configuration of **Verity Voting 2.3.4** will be deployed that conform to conducting a Pennsylvania Straight Party General election, as well as a Closed Primary election. In all instances **Verity Voting 2.3.4** documentation will be followed in the setup of the configurations.

6.3 Test Sequence

While there is no required sequence for performing voting system certification testing and audits, there are prerequisite tasks for some testing. Any needed prerequisites are contained within the suite for that test.

6.4 Test Operations Procedures

An inventory has been performed to verify the voting equipment received contains hardware and software elements as defined in the TDP prior to commencement of testing.



Throughout the testing effort, test suites and modules will be marked as follows:

- **Accept** – Test is accepted as successful.
- **Reject** – Test is rejected as unsuccessful.
- **NT** – Not Testable is used for test modules that cannot be completed. For example, if failure of one test modules failure precludes attempting subsequent test modules, the latter will be marked as NT.

Test results **Reject** and **NT** will include comments by the Test Engineer explaining the reason for the result.

Issues encountered during review and testing will be documented on the Discrepancy Report and communicated to the EAC. Test findings showing that an aspect of the voting system does not conform to the requirements of the identified test standard will be marked as Documentation discrepancies, Source Code Review discrepancies, Hardware discrepancies, or Functional discrepancies.

All responses provided by the vendor are noted in the Discrepancy Report attachment to the Certification Test Report.

7 Approval Signatures

SLI:

Traci Mapps
Director of Operations, SLI Compliance
May 2nd, 2019

End of Verity Voting 2.3.4 Certification Test Plan
